

GKN Driveline International GmbH  
Hauptstrasse 130  
53797 Lohmar

2<sup>nd</sup> November 2004  
Ne/bec (20040553)  
Q04060W000

**Counter track joint with optimised building space**

Claims

1. A constant velocity joint (11) in the form of a counter track joint with the following characteristics:
  - an outer joint part (12) having a first longitudinal axis ( $A_{12}$ ) and comprising first outer ball tracks (18) and second outer ball tracks (20);
  - an inner joint part (15) having a second longitudinal axis ( $A_{15}$ ) and comprising first inner ball tracks (19) and second inner ball tracks (21);
  - the first outer ball tracks (18) and the first inner ball tracks (19) form first pairs of tracks;
  - the second outer ball tracks (20) and the second inner ball tracks (21) form second pairs of tracks;
  - the pairs of tracks each accommodate a torque transmitting ball ( $17_1, 17_2$ );
  - a ball cage (16) is positioned between the outer joint part (12) and the inner joint part (15) and comprises circumferentially distributed cage windows ( $24_1, 24_2$ ) which each receive at least one of the balls ( $17_1, 17_2$ );
  - when the joint is in the aligned condition, the first pairs of tracks open in the central joint plane (E) in a first direction  $R_1$ , and
  - when the joint is in the aligned condition, the second pairs of tracks open in the central joint plane (E) in a second direction  $R_2$ ,

characterised in

in that, when the joint is in the aligned condition, the ratio  $V_1$  of the pitch circle diameter PCDS of the shaft toothing in the inner joint part (15) in the power of three relative to the product of the ball diameter  $DK$  squared and pitch circle diameter PCDB of the balls (17) assumes a value ranging between 0.9 and 1.3, i.e.

$$0.9 < V_1 < 1.3 \text{ with } V_1 = \text{PCDS}^3 / DK^2 \times \text{PCDB}.$$

2. A constant velocity joint (11) in the form of a counter track joint with the following characteristics:
  - an outer joint part (12) having a first longitudinal axis ( $A_{12}$ ) and comprising first outer ball tracks (18) and second outer ball tracks (20);
  - an inner joint part (15) having a second longitudinal axis ( $A_{15}$ ) and comprising first inner ball tracks (19) and second inner ball tracks (21);
  - the first outer ball tracks (18) and the first inner ball tracks (19) form first pairs of tracks;
  - the second outer ball tracks (20) and the second inner ball tracks (21) form second pairs of tracks;
  - the pairs of tracks each accommodate a torque transmitting ball ( $17_1, 17_2$ );
  - a ball cage (16) is positioned between the outer joint part (12) and the inner joint part (15) and comprises circumferentially distributed cage windows ( $24_1, 24_2$ ) which each receive at least one of the balls ( $17_1, 17_2$ );
  - when the joint is in the aligned condition, the first pairs of tracks open in the central joint plane (E) in a first direction  $R_1$ , and
  - when the joint is in the aligned condition, the second pairs of tracks open in the central joint plane (E) in a second direction  $R_2$ ,

characterised in

that the ratio V3 of the pitch circle diameter PCDS of the shaft toothing in the inner joint part (15) relative to the OR factor is between 0.34 and 0.37, wherein the OR factor is defined by the sum of the pitch circle diameter PCDB of the balls (17) and the ball diameter DK, so that

$$0.34 < V3 < 0.37 \text{ with } V3 = PCDS / (PCDB + DK).$$

3. A constant velocity joint according to claim 1 or 2,

characterised in

that the ratio V2 between the IR factor and the OR factor assumes values between 0.525 and 0.585, wherein the IR factor is defined by the difference between the pitch circle diameter PCDB of the balls (17) when the joint is in the aligned condition and the ball diameter DK, and wherein the ball diameter DK and the OR factor are defined by the sum of the pitch circle diameter PCDB of the balls (17) when the joint is in the aligned condition and the ball diameter DK, so that

$$0.525 < V2 < 0.585 \text{ with } V2 = (PCDB - DK) / (PCDB + DK).$$

4. A constant velocity joint according to any one of claims 1 to 3,

characterised in

that the ratio V4 of the pitch circle diameter of the shaft toothing in the inner joint part PCDS relative to

the IR factor ranges between 0.58 and 0.64, wherein the IR factor is defined by the difference between the pitch circle of the balls (17) when the joint is in the aligned condition and the ball diameter DK, so that

$$0.58 < V4 < 0.64 \text{ with } V4 = \text{PCDS} / (\text{PCDB} - \text{DK}).$$

5. A constant velocity joint according to any one of claims 12 to 4,

characterised in

that the first pairs of tracks (18, 19) and the second pairs of tracks (20, 21) are arranged so as to alternate across the circumference.

6. A constant velocity joint according to any one of claims 1 to 5,

characterised in

that the joint comprises six balls (17).

7. A constant velocity joint according to any one of claims 1 to 5,

characterised in

that the joint comprises eight balls (17).

8. A constant velocity joint according to any one of claims 1 to 7,

characterised in

that the joint is designed to have a maximum angle of articulation ranging between  $25^{\circ}$  and  $45^{\circ}$ .

9. A constant velocity joint according to claim 8,

characterised in

that the joint is designed to have a maximum angle of articulation ranging between  $30$  and  $40^{\circ}$ .

10. A constant velocity joint according to claim 9,

characterised in

that the outer joint part comprises a joint base (25) which is formed on one side and which comprises a formed-on journal (26).

11. A driveshaft comprising two constant velocity joints and an intermediate shaft,

characterised in

that at least one of the constant velocity joints (11, 21) is designed in accordance with one of claims 1 to 10.

12. A driveshaft according to claim 11,

characterised in

that the intermediate shaft comprises an axial plunging unit (28).

13. A motor vehicle with at least two driveshafts which each comprise two constant velocity joints and an intermediate shaft and which each, as sideshafts, connect a differential drive to a wheel hub unit,

characterised in

that at least one of the joints (11, 31) of each drive-shaft is designed in accordance with any one of claims 1 to 10, and that the shaft journal of same is inserted into the differential drive (32).

14. A motor vehicle with at least two driveshafts which each comprise two constant velocity joints and an intermediate shaft and which each, as sideshafts, connect a differential drive to a wheel hub unit,

characterised in

that at least one each of the joints (11, 31) is designed in accordance with claims 1 to 10 and that the joint journal of same is inserted into the wheel hub unit (33).

15. A motor vehicle with a driveshaft which comprises at least two constant velocity universal joints and an intermediate shaft and is used as a propeller shaft,

characterised in

that at least one of the constant velocity joints (11, 38/53) is designed in accordance with any one of claims 1 to 10.

16. A motor vehicle according to claim 15,

characterised in

that the propeller shaft comprises three intermediate shafts (43, 47, 51) which are connected via joints (11, 50) of which one is designed as a constant velocity joint according to any one of claims 1 to 10.

17.A motor vehicle according to any one of claims 15 or 16,

characterised in

that at one end of the propeller shaft there is arranged a rubber disc joint (42).

18.A motor vehicle according to any one of claims 15 to 17,

characterised in

that at one end of the propeller shaft there is arranged a constant velocity plunging joint (53).

19.A motor vehicle according to any one of claims 15 to 18,

characterised in

that the driveshaft comprises a Hooke's joint (50).

20.A motor vehicle according to any one of claims 15 to 19,

characterised in

that the propeller shaft connects a gearbox output with a differential input.